

The Role of Artificial Intelligence Applications in Managing the Employee Performance Evaluation: An Iraqi Case Study

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ABSTRACT

Employees are the most valuable resource in any organization. It is the main cause of the success of a business. The evaluation of employee performance is a very important task as it shows how the employee's skills are improving. The HR department is responsible for this task. The employee performance evaluation is complex and time-consuming. In the last decade, information technology tools have undergone a huge evolution and can help with this complex task. Artificial Intelligence (AI) is a recent science that consists of building systems that imitate human behavior. It is widely used in many applications like healthcare, banking, and finance. This thesis focuses on studying the impact of artificial intelligence on the employee evaluation process. An analytical-descriptive methodology was used. Intelligence is considered an independent variable. However, employee performance evaluation is the dependent variable (DV). Four dimensions of the DV were considered: objectives and key results, skills gap analysis, tracking training completion, and project or task management tools. A questionnaire of 34 items was built and distributed to the IT employees of the Babylon Education Directorate. 295 answers were collected. SPSS software was used to examine the answers. The MANOVA test was applied to validate the study hypotheses. The result shows that AI has a significant positive impact on the evaluation of employees' performance in all dimensions.

KEYWORDS: Artificial intelligence, employee performance, MANOVA, objectives and key results, skills gap analysis, tracking training completion, project or task management tools

I. INTRODUCTION

In any organization, employees are valuable assets and the key to success. Managers and employers should comprehend that motivated employees can make meaningful contributions to the organization (Ali & Anwar, 2021). For this reason, evaluating employee performance is any company's central human resources task. Indeed, performance evaluations are a typical routine in most victorious companies (Grissom & Bartanen, 2019). It can be seen as a link between business expectations and accurate outcomes. In addition, it may help employees in aligning with the business goals. Employee performance evaluation surveys the progress and gives important Feedback for areas that need more production. Furthermore, evaluating employees' performance may help in management decisions regarding promotions, pay raises, or even firing members from teams (Sabuhari, et al., 2020).

The evaluation process can be defined as assessing a particular object and assigning a number to this object according to specific ways. However, performance can be defined in various ways. Some experts say that performance is the contribution that can be given by a person, division, or unit to complete the goals (Lai & Bower, 2019). Therefore, an employee's performance level determination consists of computing this employee's contribution to the company (Devi, 2019). For computing the contribution of an employee in a company, many methods have been used that will be discussed later in this study's theoretical part (Ahn, et al., 2018; Clayton & Headley, 2019; Djunaidi, et al., 2019; Francis, 2018; Murphy, 2020).

The Human resource department should evaluate employees. This task may be complex and time-consuming if it is done manually (Piwowar-Sulej,

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2020). Recently, the massive development of technology offers new tools and techniques that may help the Human resource department in this task. In this study, the role of artificial intelligence in evaluating employee performance will be considered.

Artificial Intelligence (AI) is one of these theories. It consists in creating systems that imitate human behaviors. AI has proven its efficacy in many sectors, such as banking, robotics, and healthcare (Glikson & Woolley, 2020). Recently, AI has played an essential role in the human resource department (Votto, et al., 2021). In addition, AI may have a significant role in the performance management system. Indeed, the data-driven assessment or review system helps maintain clarity and avoids incomprehension or doubts. It also helps in avoiding bias, the "*Halo effect*," and "*Stereotypes*" (Glikson & Woolley, 2020). This study will study the role of artificial Intelligence tools in evaluating employee performance.

The primary goals of this study consist of defining the process of employee evaluation performance, discussing the limitation of classical methods used in evaluating employee performance, and studying the benefit of using AI in evaluation performance systems and the role of using AI in employee evaluation performance in Iraq.

This paper is organized into seven sections. First, Section II represents the evaluation of the employee performance process. Afterward, the research questions of this study are illustrated in Section III, followed by the methodology and the hypotheses in Section IV. This study's questionnaire is emphasized in Section V. The results are represented and discussed in Section VI. Finally, this paper is closed in Section VII.

II. Evaluation of Employee Performance

Table 1: Benefits and limitations of the different employee evaluation methods

Method	Benefits	Drawbacks
Ranking method	<ul style="list-style-type: none"> -Fastest -Transparent -Cost Effective -Simple and easy to use 	<ul style="list-style-type: none"> -Less goal -Enthusiasm issues that are not rated at or near the top of the list. -Appropriate for a small company. -Workers' strengths and weaknesses cannot be easily -Determined.
Graphic rating scales	<ul style="list-style-type: none"> -Easy. -Simple to build -Simple to use. -Results are standardized, which allows comparisons to be made between employees. -Decrease personal bias. 	<ul style="list-style-type: none"> -Rating may be subjective. -Each element is equally important in evaluating the employee's performance.

The performance is also called job performance or actual performance. It represents the actual achievement and the quality of work performed by an employee. The result of work in quality and quantity completed by an employee in carrying out his functions by the responsibilities assigned to them is defined as performance or work achievement. Performance can be seen as an employee's outcome or success level while performing single or multiple tasks. The success level can be computed by comparing criteria (Andreas, 2022).

Each company chooses its evaluation cycles. Usually, the companies drive employee performance evaluations once per year. Some companies run evaluations only when employees come at the end of their initial probationary period. Persons that act well on that evaluation are typically terminated for their probationary status. The evaluation information is kept in the employee's document and may be used by future employers (Saffar & Obeidat, 2020). The HR department is the main responsible for the employee promotion process.

The HR department may use several techniques to evaluate employee work performance (Collings, et al., 2021). Usually, two types of measures are utilized in performance evaluation:

- Objective measures are directly quantifiable, and
- Subjective measures are not directly quantifiable.
- Performance Appraisal is classified into two classes: Traditional Methods and Modern Methods.

Each evaluation technique has benefits and drawbacks (Dagar, 2014; Pichler, 2019).

Table 1 shows some advantages and limitations of the primary evaluation methods (Aguinis, 2019; Drucker, 2012; Morgeson, et al., 2019).

Critical incident	<ul style="list-style-type: none"> -Easy and economical to develop and administer. -Based on direct observations. -It is time-tested and provides more face time. 	<ul style="list-style-type: none"> -Time-consuming -Need much work to analyze the associated data -Difficult to persuade people to communicate their critical incidents -Offers a personal perspective of organizational problems.
Essays	<ul style="list-style-type: none"> -Offers only the current status of the worker's performance. -Can include all elements. -Examples are given. -Delivers Feedback. 	<ul style="list-style-type: none"> -Take time -Managers can write biased essay -It is hard to find an influential writer for essays.
MBO	<ul style="list-style-type: none"> -Simple to build and compute -Employee encouraged as he is aware of expected functions and responsibilities. -Performance-oriented diagnostic system -Facilitates employee counseling and direction. 	<ul style="list-style-type: none"> -Complex and time consuming -Employees usually do not agree on objectives. -Misses intangibles like honesty, integrity, and quality -Understanding goals may change from manager to manager and employee to employee.
BARS	<ul style="list-style-type: none"> -Describe employee performance in a good way -More goals can be set -Acceptance is easy for employees and managers 	<ul style="list-style-type: none"> -Scale independence may not be reliable. -Behaviors are activity oriented rather than result oriented -Very time-consuming for generating BARS. -Each job will require creating a separate BARS scale.
360 Degree	<ul style="list-style-type: none"> -Accurate results -Good employee development technique. -Lawfully and secure -More objective is a multi-rate system. 	<ul style="list-style-type: none"> -Time-consuming -Very high cost -Depending on the nature of the jobs and company -Difficult to maintain confidentiality in a small organization

III. Research questions

In this paper, the following question will be addressed:

R0: What is the impact of Artificial Intelligence on the evaluation of employee performance and its dimensions (Objective and key results, skill gaps analysis, training completion training, project management tools)?

The following questions should be addressed first to answer the initial question mentioned above:

R01: Do the objective and key result constitute an essential part of the evaluation of employee performance

R02: Does the skill gaps analysis constitute an essential part of the evaluation of employee performance?

R03: Does the training completion tracking constitute an essential part of the evaluation of employee performance?

R04: Do the project management tools constitute an essential part of the evaluation of employee performance?

IV. Methodology and Hypotheses

This paper's authors adopt a descriptive-analytical methodology to describe the relationship between artificial intelligence applications and the evaluation of employee performance processes. The following tools and data sources are used to achieve the methodology of this study:

- The library approach by looking at the various references related to the aspects of the subject
- Interviews and field visits to companies working in this field
- Electronic surveys implemented using Google Forms and distributed via social media tools like WhatsApp, Facebook, and others

The following variables are identified (see Figure 1):

Dependent variable: Employee performance

- Objectives and Key Results

- skills gap analysis
- Track training completion
- project or task management tool

Independent variable: Artificial intelligence

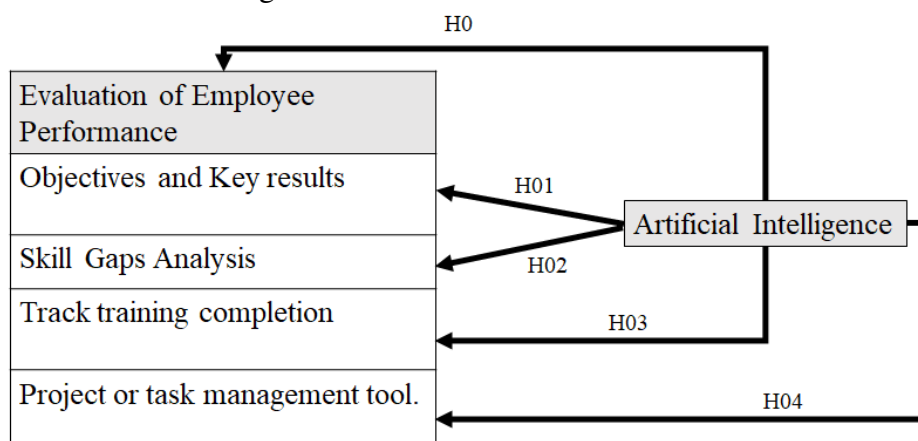


Figure 1: The Conceptual framework

Based on Figure 1, the study hypothesis can be formulated as follows:

H0: There is an impact of Artificial Intelligence on the evaluation of employee performance and the following hypotheses are derived:

- H01: There is a significant positive impact of Artificial Intelligence on objectives and key results.
- H02: There is a significant positive impact of Artificial Intelligence on skills gap analysis.
- H03: There is a significant positive impact of Artificial Intelligence on Track training completion.
- H04: There is a significant positive impact of Artificial Intelligence on project or task management tools.

V. Questionnaire

To describe the hypothesis and variables of this paper, the authors built a questionnaire of 34 items (see Table 2).

Table 2: Description of the questionnaire prepared for this study

Variable	Dimension	Number of Questions
Personal Information	Sex	1
	Age	1
	Degree	1
	Experience	1
Independent Variable: Artificial Intelligence		10
Dependent Variable: Evaluation of Employee Performance	Objective and key results	5
	Skill gaps analysis	5
	Track training completion	5
	Project or task management tool	5

The questionnaire's items are illustrated in Tables 3 to 7. A code is generated for each item. These codes are used to represent the results of SPSS and statically tools in this chapter and the following one.

Table 3: Items that represent the independent variable (Artificial Intelligence)

Code	Item
AI1	The organization is trying to familiarize its employees with the tools of artificial intelligence.
AI2	The organization considers the use of artificial intelligence tools a prerequisite for success and development.
AI3	The organization uses artificial intelligence tools to monitor the daily tasks of employees.
AI4	The organization introduces artificial intelligence tools in analyzing the skills and weaknesses of employees.
AI5	The organization uses artificial intelligence tools to evaluate the development of employees' skills after completing training.
AI6	The organization uses artificial intelligence tools to enable employee performance regularly.
AI7	The organization relies on artificial intelligence to organize its projects.

AI8	The organization is interested in hiring experts in the field of artificial intelligence in the organization.
AI9	The Foundation is interested in using the means and tools of artificial intelligence.
AI10	The organization evaluates periodic courses and seminars to inform employees of the importance of using artificial intelligence.

Table 4: Items that represent the dependent variable dimension: Project Management Tools

Code	Item
PR1	The organization relies on enterprise management tools and tasks to organize and implement its projects.
PR2	The organization trains employees to use these tools.
PR3	The organization uses these tools to monitor the implementation of the tasks assigned to each employee.
PR4	Using organization and task management tools is easy and important.
PR5	Organization/task management tools help speed up the task completion process.

Table 5: Items that represent the dependent variable dimension: Skills Gaps Analysis

Code	Item
SK1	The organization understands the importance of developing employee skills.
SK2	The organization is interested in analyzing the weaknesses of employees to develop them.
SK3	The development of employee skills is taken into account when evaluating performance and productivity.
SK4	The Corporation is interested in offering training courses that are appropriate to the level of employees' skills.
SK5	The institution periodically evaluates the skills of employees according to the tasks required of them.

Table 6: Items that represent the dependent variable dimension: Training Track

Code	Item
TR1	The organization encourages employees to participate in training courses.
TR2	The institution follows up on employee participation in training courses.
TR3	The institution follows up on the percentage of employee skill change after training.
TR4	The institution monitors the employees' attendance at the training sessions.
TR5	The Foundation is interested in clarifying the importance of training courses for employees.

Table 7: Items that represent the dependent variable dimension: Objectives and Key Result

Code	Item
OJ1	The organization evaluates employees according to productivity.
OJ2	Achieving goals is a key component of employee evaluation utilizing a self-evaluation report.
OJ3	The employee should know his daily goals.
OJ4	The employee should know his daily goals.
OJ5	The time of the employee's arrival to work is taken into account in the evaluation process.

The five Likert scale is used with the weight represented in Table 8.

Table 8: Weights used to represent questionnaire answers

Category	Strongly disagree (SD)	Disagree (D)	Neutral (N)	Agree (A)	Strongly agree (SA)
Degree	1	2	3	4	5

VI. Results and Discussion

In this section, the result of analyzing the data collected by the questionnaire will be presented. First, the sample will be described. After that, the reliability of the survey will be discussed. Later, the hypotheses will be examined.

1. Sample

Information Technology Employees and Computer Teachers of the Babylon Education Directorate were taken as a society for this study. The number of computer teachers and information technology employees in the Babylon Education Directorate is equal to 1180. The sample size is computed using the following formula (Fugard, 2015):

$$n = p * (1 - p) * \left(\frac{Z}{E}\right)^2$$

$$size_{sample} = N * \frac{n}{n + N - 1}$$

Where,

- N is equal to 1180, known as the population size
- Z is equal to 1.96 for a confidence level of 95%, known as the normal standard distribution value reflecting the confidence level; for a value of 1.645, the confidence level is 90% and for a value of 2.576, the confidence level is 99%.
- E is equal to 5%, known as the required margin of error
- p is equal to 0.5, known as the percentage of successes in the population ranging between 0 and 1

According, the sample size for this study is calculated and recorded for a value of 290 records.

The author distributed 350 questionnaires among the employees, who received 295 answers for a rate of 84.2%. In the questionnaire, the authors collected some personal information (gender, age, academic degree, and experience level) as represented in Table 9.

Table 9: Sample description according to age, education, gender, and experience

Variant	Class	Number
Gender	Male	132
	Female	163
Experience	Less than 5	69
	Between 6 and 10	61
	Between 11 and 15	79
	Between 16 and 20	54
	Greater than 20	32
Age	Between 20 and 30	64
	Between 31 and 40	146
	Between 41 and 50	69
	Greater than 50	16
Education level	Bachelor	191
	Diploma	12
	Master	69
	Doctorate	19

2. Survey Reliability

Cronbach's alpha was used to determine the reliability of the questionnaire. Cronbach's alpha is a static method for determining the internal consistency of a questionnaire (Amirrudin, et al., 2021). It establishes how closely connected a set of items is. It is a statistic for scale dependability. Figure 2 displays Cronbach's alpha values as well as their implications.

Less than 0.5	Unacceptable
0.5 - 0.6	Poor
0.61 - 0.7	Questionable
0.71 - 0.8	Acceptable
0.81 - 0.9	Good
0.9 - 1.0	Excellent

Figure 2: Internal consistency as the signification of different Cronbach's alpha values

Cronbach's alpha was used to calculate questionnaire stability on a small sample of 30 persons. Figure 3 displays Cronbach's alpha and its accompanying constancy for the tiny sample.

Artificial Intelligence	Value: 0.833
	Constancy: Good
Objectives and Key Results	Value: 0.882
	Constancy: Good
Skill Gaps Analysis	Value: 0.811
	Constancy: Good
Track Training Completion	Value: 0.805
	Constancy: Good
Project or Task Mangement Tool	Value: 0.832
	Constancy: Good
Total	Value: 0.934
	Constancy: Excellent

Figure 3: The stability study for the different variants was measured for a small sample of 30 people

3. Hypothesis Analysis

In this part, the main hypothesis and its sub-hypotheses are examined.

A. Linear Relationship and Normal Distribution

Figure 4 shows the histogram corresponding to the dependent variable “evaluation of employee performance”. As illustrated in this figure, there is a normal distribution of this variable.

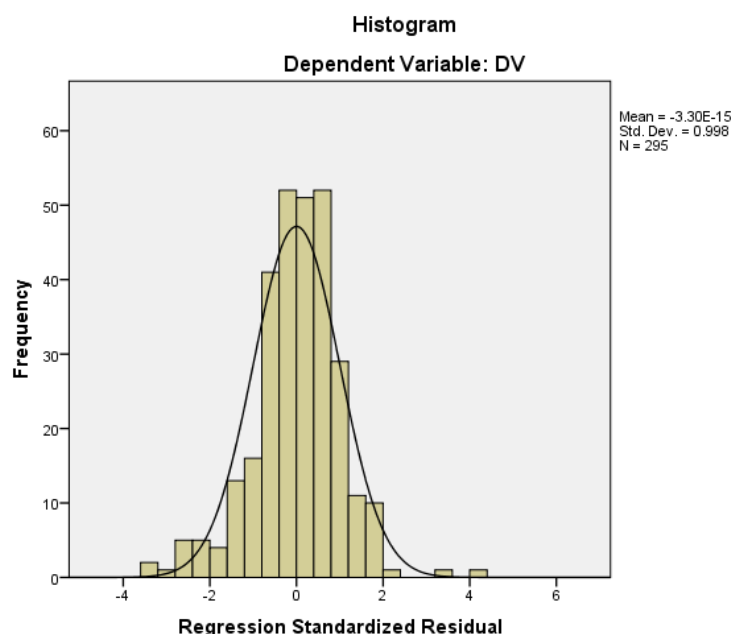


Figure 4: Normal distribution of the dependent variable

Figure 5 depicts the link between dependent and independent variables. The variables in the study have a linear relationship, as shown in this graph. Pearson correlation can thus be used to investigate the primary hypothesis H0 and its sub-hypotheses (H01, H02, H03, and H04).

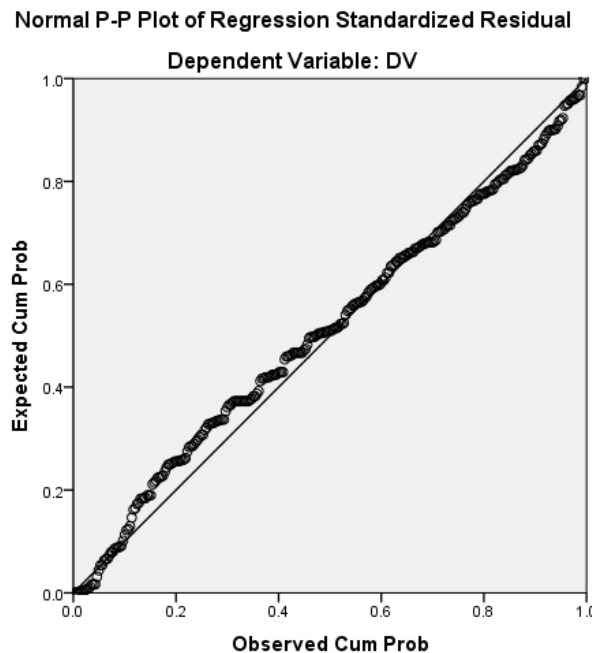


Figure 5: Relationship between dependent and independent variables of the study

B. Correlation between Variables

As the model is linear and the values are normally distributed, the Pearson method can be used to test the correlation between variables (Jebli, et al., 2021). Pearson correlation is variable between -1 and 1. The interpretation of this value can be done as follow:

- Greater than 0.5 (Strong positive correlation)
- Between 0.3 and 0.5 (Moderate positive correlation)
- Smaller than 0.3 (Weak positive correlation)
- Between 0 and -0.3 (Weak negative correlation)
- Between -0.3 and -0.5 (Moderate negative correlation)
- Smaller than -0.5 (String negative correlation)

For a positive correlation, the variables vary in the same direction. However, variables change in different directions in negative correlation. Table 10 shows the correlation between the independent and dependent variables.

Table 10: Correlation between Dependent and independent variables

Variables		Dependent Variable	Independent Variable
Dependent Variable	Pearson Correlation	1	.689**
	Sig. (2-tailed)		.000
	N	295	295
Independent Variable	Pearson Correlation	.689**	1
	Sig. (2-tailed)	.000	
	N	295	295

Dependent Variable: Evaluation of Employee Performance

Independent Variable: Artificial Intelligence

** Correlation is significant at the 0.01 level (2-tailed)

As illustrated in Table 10, the sig value is equal to zero. Therefore, there is a significant relationship between Artificial Intelligence and the evaluation of employee performance. The Pearson value is equal to 0.689. Therefore, there is a strong positive correlation between these variables. Therefore, we can conclude that more use of AI tools leads to better evaluation of the employees' performance. The author can justify this result:

- AI tools like "360Learning¹" can accurately detect the skill gaps for each employee.
- AI tools such as "Teramind²" can detect and monitor employee activity easily.
- AI tools can enhance project management applications. They can assist in planning, scheduling, automation, and monitoring all tasks and jobs.

¹ <https://360learning.com/>

² <https://democompany.teramind.co/>

C. Hypotheses Approval

In this paper, AI is considered as an independent variable. However, four dimensions of the dependent variable are used. For this reason, MANOVA will be used to test the main and sub-hypotheses.

D. MANOVA Test

MANOVA is a newer form of ANOVA, which evaluates the statistical link between one continuous dependent variable and an independent grouping of factors (Smith, et al., 2020). The MANOVA, on the other hand, broadens this testing by taking into account more than one dependent variable. In this section, the author uses One-Way MANOVA to prove the impact of "Artificial Intelligence" and "evaluation of employee performance" on the fundamental premise and the associated sub-hypotheses. The MANOVA test results in this investigation are shown in Table 11.

Table 11: Results of the MANOVA test.

	Effect	Value	F	Hypothesis DF	Error DF	Sig.	Partial Eta Squared
AI	Pillai's Trace	1.225	2.804	160.000	36.000	.000	0.72
	Wilks' Lambda	0.184	3.321	160.000	43.201	.000	0.89
	Hotelling's Trace	2.576	4.017	160.000	78.000	.000	0.49
	Roy's Largest Root	1.834	11.646 ^c	40.000	54.000	.000	0.27

From the MANOVA tests, we can conclude that there is an impact between AI and the evaluation of employee performance (the Sig value is smaller than 0.001). The partial Eta Square (η^2) can be interpreted as (Correll, 2021):

- A small effect of η^2 between 0.01 and 0.05
- A medium effect of η^2 between 0.06 and 0.13
- A significant effect of $\eta^2 > 0.14$

As all partial Eta squared is greater than 0.14. Therefore, a significant impact of artificial intelligence on the evaluation of employee performance is present. Table 12 shows the eta and Eta square values for all variables.

Table 12: Compare means

Measures of Association	Eta	Eta Squared
AI * Objectives and key results	0.80	0.64
AI * training completion	0.60	0.36
AI * project management tools	0.67	0.44
AI* Skills caps analysis	0.86	0.73

According to Table 12, the authors observed that artificial intelligence has an impact on objectives and key results. Eta has a value of 0.8; thus, there is a positive. The amount of the changes (Eta Squared) that happen on objective and results due to the artificial intelligence tool is equal to 64%. This value validates the sub-hypothesis H01.

In addition, artificial intelligence has an impact on skill gaps analysis. Eta has a value of 0.86. This value is positive. The amount of variation represented by (Eta Squared) that occurred on skill gaps analysis due to the artificial intelligence tool is equal to 73%. This value validates the sub-hypothesis H02.

Moreover, artificial intelligence has an impact on training completion tracking. Eta has a value of 0.80; this value is positive. The amount of variation represented by (Eta Squared) that occurred on training completion tracking due to the artificial intelligence tool is equal to 36%. This value validates the sub-hypothesis H03.

Finally, artificial intelligence has an impact on project management tools. Eta has a value of 0.67; this value is positive. The amount of variation represented by (Eta Squared) that occurred on training completion tracking due to the artificial intelligence tool is equal to 44%. This value validates the sub-hypothesis H04.

VII. Conclusion

Employees are a company's most significant asset and the main reason for its success. Employers and managers should be aware that motivated workers can make a significant contribution to the company. For this reason, assessing employee performance is a very important task. It is the main responsibility of the human resources department in each organization.

Performance evaluations are a common practice in the majority of successful businesses. In this thesis, the author examines the impact of using artificial intelligence on employee evaluation performance. An analytical-descriptive methodology has been used. Two main variables have been selected:

- Independent variable: artificial intelligence

- Dependent variable: evaluation of employee performance

Four dimensions of the dependent variable are considered in this study: objectives and key results, skills gap analysis, tracking training completion, and project or task management tools. The author started by defining the performance evaluation process. All types of this evaluation were presented. The process of evaluating performance was described. After that, artificial intelligence was illustrated. The authors focused on presenting the different types of AI techniques. Later, the questionnaire used in this study was presented. It is composed of 34 items that represent personal information, independent variables, and all dimensions of dependent variables. This questionnaire was distributed to the information technology employees in the Babylon Education Directorate. 295 answers were collected. These answers were analyzed using SPSS and statistical tools. The results indicate that the sample is normally distributed between male and female employees. Almost all employees in the sample are educated (degree changes from master's, bachelor's, Ph.D., and higher diplomas). In addition, the sample is young (only 16 employees are older than 50).

The results also illustrate that:

- The employees and teachers of the Babylon Education Directorate agree that the directorate tries to represent AI for the employees and use AI tools in the evaluation of its employees.
- All employees in the sample agree that the Babylon directorate uses project management applications for scheduling and monitoring projects. In addition, the directorate trains the employees on this software.
- Employees in the sample agree that the directorate of Babylon is interested in analyzing the skill gaps of the employees.
- All employees of the sample agree that the directorate of Babylon takes into consideration the implemented objectives and the results of the employees during the evaluation steps.
- Employees of the sample agree that the directorate of Babylon motivates the employees to assist and complete the training. In addition, it evaluates the improvement of employees' skills after training.

To examine the study hypotheses, the MANOVA test was used, and many dependent variables were employed. The result of MANOVA illustrated the impact of artificial intelligence on objectives and key results, skill gap analysis, training completion tracking, and project management tools.

After performing this study, the author suggests the following points:

- Motivate employees to perform online courses in AI and its sub-sciences.
- Motivate employees to improve their skills in information technology.
- Covers the fees for AI training for employees.
- Invites AI expertise to explain to the employees this recent science and how it can improve their lives and their productivity.
- Try to follow the employee's daily tasks.
- Evaluate employee performance and give a bonus to the most productive employee.
- Promote the employees according to their performance.
- Be sure the employees know and understand their daily goals and objectives. Indeed, success depends on reaching clear goals.
- Encourage teamwork
- Listen to news, Creative and innovative ideas.
- Transform the employee's skills and capabilities into work and achievement. Therefore, the employee gets the evaluation he aspires to reach.
- Benefiting from experienced people and taking guidance and advice from them to make the right and important decisions at work.
- Prepare effective plans to train and prepare all employees for using artificial intelligence applications.
- Develop a good encouragement system for those who are distinguished in the field of work in the artificial intelligence program.
- Learn from other institutions' experiences in the field of Artificial Intelligence.

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